UDOT RESEARCH
ENGINEERING THE FUTURE

newsletter

January 2008

Happy New Year!

Welcome to the UDOT Research Newsletter. The newsletter is a quarterly publication that provides current information on the Division's research activities.

We're starting our new year here at Research with a new look. After taking some time to reevaluate our missions and goals, we decided to accompany our new vision with a new logo and a new format for our newsletter.

Our goal in Research is to be at the forefront of innovation, and we will be using this newsletter to bring you information on what's new and progressive in transportation. We will also share with you what UDOT is researching and how we are implementing new technologies. We hope you will find the changes we've made informative and useful.

We will also be coming to the regions to present our annual report, which includes a brief description of our program and the projects we're funding, along with the progress of those projects, and other useful information. We look forward to visiting with you, hearing your ideas and gaining a better understanding of your research needs.

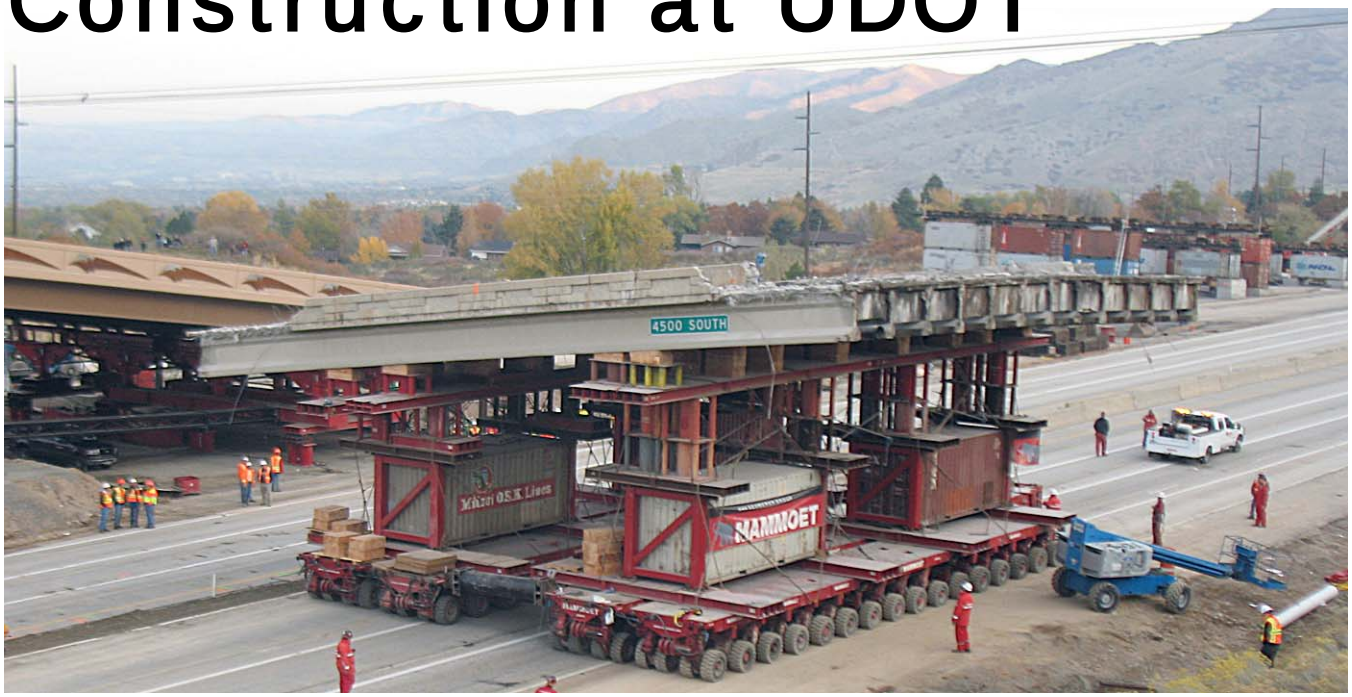
On behalf of the Research team, I wish you a very happy and successful 2008. See you at our meetings.

Sincerely,
Michael Fazio
Deputy Director for UDOT Research & Development

In This Issue: (click on desired article, click on logo at top to return to this page)

By Daniel Hsiao
UDOT Research Division

Accelerated Bridge Construction at UDOT



With structural deficiencies in the bents, girders and deck, the 4500 South Bridge over I-215 in Salt Lake City had to be replaced.

The project, however, had the potential to greatly inconvenience users who relied on the bridge as one of the few available roadways for crossing I-215. A traditional replacement process would have shut down this crossing for months, creating substantial congestion at the other crossings and causing significant delays to daily commuters. To mitigate these public impacts, the Utah Department of Transportation (UDOT) - supported by a $1 million grant from the FHWA Highways for LIFE program - opted to undertake this project using innovative Accelerated Bridge Construction (ABC) techniques.

Applying ABC Techniques

The 4500 South Bridge replacement was the first time in America an old four-span bridge was removed and then replaced by a new bridge (172 feet single-span) in less than 48 hours. The three most notable elements of the ABC techniques that enabled this project's rapid completion were:

1. Employing the innovative Construction Manager/General Contractor (CMGC) contracting method to shorten the project schedule by a full construction season and enable the contractor to be on board when design began.
2. Using a Self-Propelled-Modular-Transporter (SPMT) to quickly move the old bridge out of position and the new one into place in one weekend.
3. Creating a 3D visualization based on detailed terrain information that enabled the project team to virtually walk through each step of the replacement, from start to finish, before the construction equipment was even turned on.

CMGC: The actual bridge removal and installation dates were set six months ahead, right after the contractor and bridge engineers were on board. The CMGC process allowed UDOT to have the bridge designers and general contractor on board before the final design began. The resulting design, led by UDOT's Jim McMinimee (Director of Project Development) and Shana Lindsey (Director of Research and Bridge Operations), was a collaborative effort between UDOT bridge engineers and the contractor, Ralph L. Wadsworth Construction Company. With the owner, designer, and contractor all coordinating on the design, the team was able to immediately recognize and resolve potential issues, incorporate lessons-learned from multiple perspectives to avoid problems, and understand the feasibility and practicality of design decisions when it came time for actual construction.

SPMT: Because of the many slopes, angles, and grade variations at the project site, this particular bridge was one of the most complicated projects undertaken using SPMTs . To match the existing site geometry, the bridge itself needed to incorporate various slopes (up to 12%) and offsets. The route below (north- and southbound I-215) has different elevations and grades (5 feet different in elevation and 4% and 2% grades, respectively). This left the design team little room for error and the construction team even less. Relying on an SPMT to put the bridge in place, added even more challenge to the project; however, the benefits of the construction not requiring months of road closures and impacting daily traffic far outweighed overcoming the technical hurdles.

Additionally, due to the magnitude of the project - moving a 172-foot, 1,500 ton single-span bridge into position after removing the existing structure - a thorough SPMT Operation Plan was required. In addition to the bridge being designed and constructed to accommodate the SPMT Operation Plan, the project area itself also had to be prepared to accommodate the machinery. A portable ramp was built and removed within 20 hours to meet the SPMT's operational requirements, allowing access the to the bridge location with ease.

3D Visualization: To help the project team provide a visual tool to the public, UDOT contracted with InteliSum to provide 3D models and animations for the 4500 South Bridge Replacement. The 3D real world terrain data of the site and surrounding area was captured using InteliSum's patented LD3 InteliCamera. This data was then processed using LD3 Modeler software to stitch together individual scans as an entire scene, wherein every pixel in the scene is intelligent and accurate. Based on this digital scene, a real world simulation was created that allowed planners and engineers to "walk through" each step of the bridge replacement to ensure that the bridge and terrain specifications would be met, thereby facilitating a smooth replacement process.

A Showcase Project

Because the bridge replacement was a unique undertaking for UDOT, it generated great interest from the media, the public and the transportation community. UDOT and FHWA chose to use the project to showcase ABC techniques as a "Watch & Learn" event. Neighboring State DOT officials, Department of Transportation executives, university researchers and local consultants and contractors were invited to attend the weekend demolition and construction-nearly 300 professionals were in attendance.

Notices were distributed long before the event to help maximize the number of industry leaders who could attend, and special workshop sessions were planned to help share information about the project. Panel discussions were held, allowing participants to ask questions of the front line experts. Project team members presented the project, outlined its goals and challenges, and demonstrated how the replacement would be completed with a 3D animation, simulating how the demolition and construction would proceed. Following the actual construction, the simulation clearly highlighted how proper planning and innovative thinking facilitated success, as the real bridge replacement paralleled the design documented in the animation.

The educational and informational events that accompanied the live demolition and construction provided attendees with in-depth knowledge of the advantages of and applications for ABC techniques. Inspired by the spirit of innovation, several attendees discussed how these techniques could be applied on bridge replacement projects in their home states.

In addition to industry interest, the event grabbed the attention of the local and national media and the public. The project video was shown on local TV channels and used in many different ways to create genuine excitement and support from the public. In addition, the project garnered impressive media coverage, with more than 100 print and broadcast stories, including CNN and ABC News. CNN picked up the story, airing animation clips and footage of the actual replacement event to show the success of this UDOT project. But perhaps the greatest attention the project received was when more than 4,000 public spectators gathered to watch construction over the weekend and surprised crews with applause as the old bridge was removed and the new one was driven into place by the SPMTs.

Success!

Employing ABC techniques resulted in great success, allowing the existing bridge to stay in service while the majority of the construction took place. Furthermore, the project-which could have resulted in five to six months of road closures and detours-only shut down I-215 for one weekend and 4500 South for 10 days. It proved how innovative techniques can reap real benefits in terms of reducing user impacts, minimizing traffic disruptions and saving travelers precious time. Overall, when user impacts were included in an analysis of the real project cost by the University of Utah Traffic Laboratory, researchers found the innovation saved the community $4 million on the project, slashing what could have been a $12 million price tag by a third!

For questions regarding this project, please contact Daniel Hsiao at dhsiao@utah.gov.

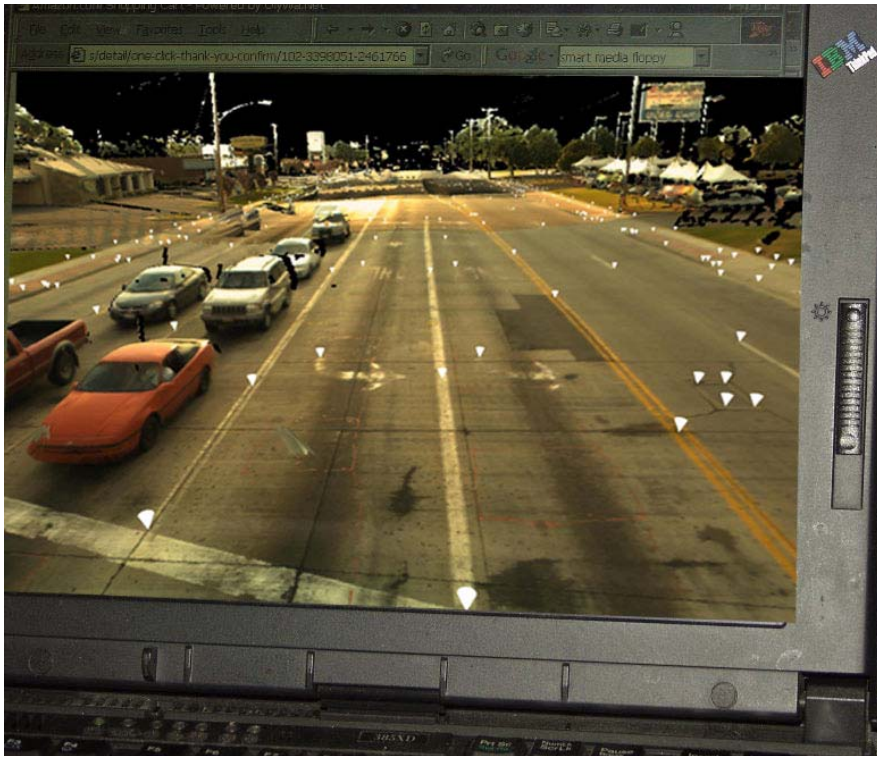
By Bruce Jenkins
President of Spar Point Research

Utah DOT Using Accelerated Bridge Construction to Slash Road Closure Times

At American Council of Engineering Companies (ACEC) fall conference in Maui; I saw a compelling demonstration of a process that Utah DOT is using to radically reduce road closure times in bridge replacement projects. Shana Lindsey, director of bridge and research operations at UDOT, showed how an Accelerated Bridge Replacement or "ABC" process is being implemented by her department in a project in Salt Lake County to replace the 4500 South bridge over I-215. [3D laser scanning played a role - see video and "Enabling Technologies" below.] Traditional methods would have meant closing both roads for six to nine months, she says - using the ABC process, I-215, a major artery, was closed for just two days, and 4500 South for ten days.

Click here to play 4500 South/I-215 bridge replacement project animation (45.8Mb MPG file). Courtesy Utah DOT

How does it work? Lindsey played an animated visualization UDOT is using to show the public and media how self-propelled modular transporters (SPMTs) was used to lift the old bridge off its supports in one piece,



and carry it to a staging area where it can be demolished. The SPMTs then picked up the new span - already fabricated adjacent to the installation site - moved it into place, and deposited it on temporary abutments. On Saturday, October 27, the old span is moved, and the new span moved into place on Sunday, October 28. I-215 was reopened Monday, and 4500 South reopened after ten days spent replacing the temporary abutments with permanent ones and securing the bridge deck.

The economic benefit of minimizing traffic disruption is substantial. Lindsey tells us UDOT estimates the economic impact of road closure in such areas at $33,500 per day - about $1 million per month. "Thus, compared with a six- to nine-month road closure, and given the costs incurred by the ABC process," Lindsey says, "we are saving the public at least $4 million in this project."

What are the costs? "Total value of this bridge replacement project is $7.5 million," Lindsey reports. "Of that, construction cost is $6.7 million." Using the ABC process in this project "cost $780,000 more than traditional methods," according to Lindsey. Of that, $350,000 is the cost of using SPMTs. The remainder goes to construct ramps to aid SPMT movement, and to fabricate temporary abutments to hold the new bridge while permanent abutments are installed. "But the temporary abutments will be reused in future projects, recovering some of that cost."

Given the number of bridges facing replacement, the potential savings is vast. Nationwide, there are 590,750 state bridges, according to Lindsey, of which 27% are structurally deficient. "In Utah, we have 1,813 state bridges," she tells us. "Of those, 5% are structurally deficient" - better than the national average, but still a significant number. "Taking state and local bridges together, in Utah there are 2,846 bridges. Of those, 8% are structurally deficient."

Enabling Technologies and Business Processes

"Key elements of the ABC concept," Lindsey explained, "are SPMTs, InteliSum's LD3, and construction management/general contractor (CM/GC), an approach where we all - designer, contractor and UDOT - are partners in developing the project."
In this project, InteliSum prepared the animated visualization using existing-conditions data captured with its LD3 technology, which fuses point clouds, RGB and GPS data. "We wanted to use InteliSum for design as well," Lindsey notes, "but we did not get them into this project early enough to use their data for design." In other projects UDOT has used LD3 data to inform engineering - "InteliSum has done a survey for an intersection project, and we designed off that data,"

Lindsey told us. "They've also done a railroad project for us." UDOT uses LD3 "for survey, public hearings for projects, and media visualizations and demonstrations," Lindsey continues. "Traditionally we would go out and collect survey points - the survey crew would probably go out two or three times before they got all the data we need. With the LD3 file, you pull it up and get all the data you want."

The third enabler of Accelerated Bridge Construction is the construction management/general contractor (CM/GC) approach to contracting. With this, Lindsey explains, "we are not going for the low bid, but instead the most economic proposal - what will get the job done faster, at the highest quality."

UDOT won a $1 million "Highways for Life" award from the Federal Highway Administration to help implement the ABC process, Lindsey reports. "For the last 50 years we've been using the same business model to build bridges. This is the only industry using same business model as 50 years ago. Why? We need to move forward."

3D Laser Scanning for Transportation at SPAR 2008 Conference in Houston

Transportation applications of 3D laser scanning will be highlighted at SPAR Conference on March 3-5, 2008 in Houston, Texas. Caltrans, MnDOT, AEROMETRIC, OPTIRA, Fenstermaker and other top practitioners will present case studies and lead discussions at Spar Point's 5th annual conference on capturing, managing and integrating 3D information for design, construction and operations. InteliSum will be one of 23 leading suppliers of hardware, software and services coming to showcase their newest technology and work processes. www.sparllc.com/spar2008.php

For questions and information, please contact
Mr. Bruce Jenkins at bruce.jenkins@sparllc.com

By Tim Ularich
UDOT Central Maintenance

Spinning The Meter Backwards

The Utah Department of Transportation (UDOT) is hoping to become more energy efficient by using the energy of the Sun and outfitting its maintenance shed with what are called "Solar Panels".

UDOT has out fitted the maintenance shed 2432 in Murray with these panels and will test energy savings. This Shed is the proud owner of a new grid-tied solar power system. The new power plant was installed as a kickoff project for UDOT to meet Governor Huntsmans's energy policy.

The solar array consists of twenty panels that provides 3600 watts during full sunshine. The solar panels output approximately 359 volts direct current (DC), which is fed into a Fronius inverter. The inverter converts the DC current into utility grade alternating current (AC), and feeds power back into Murray City's power grid when not being used by the station.

The excess power is being used at some other businesses or homes on Murray's grid, but the station is being credited for the power generation. A special bi-directional meter monitors the amount of power that is fed back into the grid so that the Murray shed is able use excess power at a later date. This grid-tied arrangement is called a Net Metering program.

In the end, it is estimated that the solar power array will provide between 10% to 15% of the Murray shed's power needs.

By the time this article prints, there will be a wind turbine in operation for the Milford maintenance facility. It will be an 1800 watt wind turbine from Southwest Windpower. Future projects are being planned for the upcoming year.

Nearly one half of the cost of these projects was funded by a $17,000 grant from the State Energy Program which was created to help the State with energy conservation and alternative energy development.

On April 26, 2006, Governor Huntsman released his comprehensive energy efficiency plan "Advancing Energy Efficiency in the State" asking all state government agencies to increase energy efficiency and develop renewable energy as part of the state of Utah's energy policy.

By the year 2015, Governor Huntsman is asking state agencies to increase their energy efficiency by 20%, combined with developing renewable energy sources to produce 2% of their power consumption. These goals were based on the 2005 energy consumption figures. If you have questions contact Tim Ularich timularich@utah.gov or 801-965-4468.

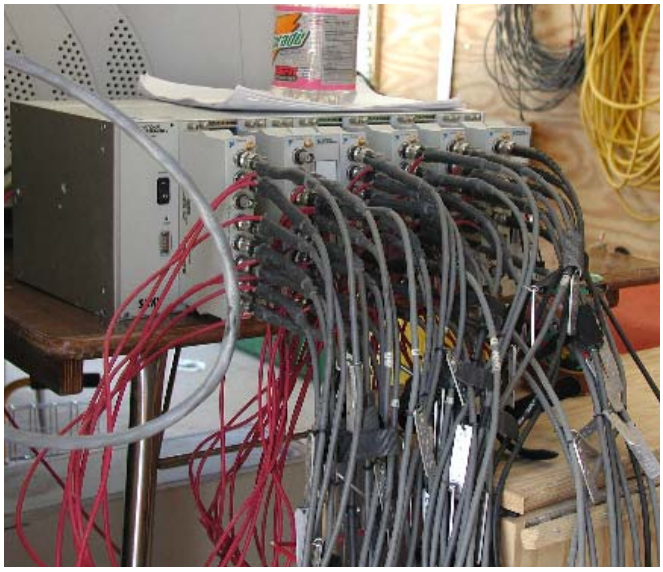
By Blaine Leonard
UDOT Research Division

Still Watching I-15:

Part 2- Dynamic Performance of Bridges

Many people remember that during the early construction efforts on the I-15 Reconstruction Project in Salt Lake County, a large and far-reaching research effort was initiated.

This unprecedented research effort, known as the I-15 National Test Bed for Transportation Research, ultimately involved 31 research projects supported with $4.67 million of special, dedicated funding. A joint effort by UDOT, FHWA, Utah State University, University of Utah, Brigham Young University, and a variety of private consultants and contractors, the I-15 Test Bed has yielded vast amounts of engineering and construction data. While most of these projects are completed, some of these research efforts are still ongoing. This article, the second in a series, summarizes the efforts initiated as part of the I-15 Test Bed to monitor and understand the dynamic performance of our highway bridges, specifically in response to a seismic event.



One of the primary elements of the I-15 Reconstruction project was the construction of 142 new bridges. Because of the high risk of seismic activity in the Salt Lake Valley, each of these bridges was designed according to the current seismic criteria. Validating the seismic design characteristics of these bridges became a primary research focus in the I-15 Test Bed. Monitoring their long term performance, particularly during an earthquake, became another goal.

In recent decades dynamic testing of structures has become a viable technique for assessing their physical characteristics and conditions. Rather than just applying a static load and monitoring the response of the structure, a vibration is induced using an oscillator. The stiffness and damping characteristics of the

structure can then be measured during various vibration frequencies using accelerometers. This technique is known as "system identification". The I-15 Reconstruction project afforded the unique opportunity to perform dynamic testing on old bridges just prior to their destruction, with testing taking place during various damage conditions. Further, it was possible to perform testing on new structures before they were opened to traffic, and establish a baseline for future measurements.

At the I-15 Test Bed site on South Temple, Dr. Kevin Womack and Dr. Marvin Halling, structural engineering professors from Utah State University, performed dynamic testing on an existing nine-span northbound bridge. As described in their 1999 report, vibrations were induced on the nine-span bridge to explore the possibility of using system identification on a large, complicated, multi-span structure, and then similar testing was performed on a single-span remnant of this bridge under various conditions, as it was selectively demolished. The research was successful, and demonstrated that system identification is possible on large bridge structures. Further, the use of system identification on the simple span structure showed promise as a technique to identify bridge damage with this non-destructive technique. As damage occurred to the bridge (through demolition efforts, in this case), the resulting changes in structural stiffness caused the measured frequencies to change. Similar tests were also performed by these researchers on a 3-span, curved girder bridge to understand the particular behavior of this type of bridge.

During 2000 and 2001, Dr. Womack, Dr. Halling, and several others, continued to explore the use of system identification on old I-15 structures. At the I-15 Test Bed site, three additional structures were instrumented, tested and evaluated before demolition, including a bent structure, a six-span bridge, and a three-span bridge. Considerable information was gleaned which enabled the researchers to refine the methods for causing vibrations, read the resulting frequencies, and interpret the data. A report issued in 2003 outlines their data and findings.

In 2001, Dr. Halling and others installed a set of permanent accelerometers on one of the new I-15 bridges, the only instrumented bridge in Utah. This strong motion station was installed on bridge C-846, the flyover ramp from westbound I-80 to SR-201 in the "spaghetti bowl" near 2100 South. The instrumentation consisted of accelerometers mounted on several locations on the bottom of the bridge deck, and three accelerometers mounted at ground level (a "free-field" site). Two years later, Dr. Les Youd, from Brigham Young University, worked with UDOT to install accelerometers at four depths beneath the ground, with the deepest being 390 feet deep. All of these accelerometers are wired to a set of recorders in a nearby shed. The data from the accelerometers are transmitted to the University of Utah Seismograph Station, where seismologists can interpret responses from an earthquake. In addition, through some recent enhancements in the communication systems at the site, the real-time vibrations of this bridge can be viewed on the web at any

time, and will be available to us for the foreseeable future.

Using the permanent strong-motion equipment installed at C-846, the USU team determined the natural frequencies and mode shapes of this new bridge, and compared the results to those computed using a finite-element software model. In addition to establishing a baseline of data for future measurements, the finite-element analysis demonstrated that computer models of the bridge predict dynamic characteristics that match actual field-measured characteristics quite well. Insights into the proper creation of the computer models were gained from this effort. After evaluating the C-846 bridge, Dr. Halling and Dr. Paul Barr instrumented and tested two more new bridges in the field, using temporary instrumentation. These two bridges were at Vine Street and I-15, and at the Cherry Hill interchange on US-89 in Farmington. Again, baseline data was gathered and finite-element models were created and evaluated. Their 2006 report describes the findings of the study and the recommendations for continued use of this technique.

Just as the system identification techniques used on the old bridges in 1999 could be interpreted to detect bridge damage, researchers hope the lessons learned at the new bridges and the data currently being collected from the strong motion site near 2100 South can aid our efforts to design, monitor and inspect our bridges. And, after an earthquake event, data from this site will provide a wealth of information about how earthquake waves propagate up through the soils and how the structure responds. The installation of monitoring systems on other new bridges is currently being planned to enhance this monitoring effort. Observing and analyzing the data from C-846 and preparing for the earthquake event is part of our on-going work to enhance our capabilities and take better care of the vast infrastructure we design, build and maintain. Stay tuned for more progress on this interesting engineering front.

So, we are still watching, learning, and building upon the significant research effort undertaken during the I-15 Reconstruction. Dynamic bridge analysis and monitoring is just one of the innovations initiated during those years. We will continue our efforts to better understand bridge performance and seismic response of these key transportation elements.

For questions regarding this project, please contact Mr. Blaine Leonard at bleonard@utah.gov

By Ken Berg
UDOT Research Division

Research Partners with Region and Vendor to Provide Drainage Solution

Standing water at 100 W. North State Street in American Fork has been a problem for years.

The shoulder grade is so flat that run-off has been collecting right in front of the business accesses for years. Recent pavement improvement projects have not been sufficiently funded to address drainage improvements.

UDOT's Research Division recognized the opportunity to help provide a drainage solution and perform research at the same time. The MD 200 Trench Former, offered by ABT, Inc., was chosen because of its flexibility and adaptability to a range of trench depths and slopes. It was decided that it would be mutually beneficial to UDOT and ABT, Inc. to evaluate the self cleaning ability of the drain at various slopes. The four slopes chosen were 0.6%, 1.0%, 1.5%, and 2.0%.

The Research Division contracted with Lyndon Jones Construction, ABT, Inc. donated the drain materials and Region Three Maintenance Division provided traffic control and construction inspection services. The drain was installed during October and November of 2007 and has proven to be successful in eliminating standing water.

A photo taken by Jim Baird of the Hydraulics Division during a recent visit to the site revealed that storm run-off is making its way into the drain, eliminating the standing water that used to be there.

The four slopes will be inspected periodically to evaluate sediment build up.

The Research Division is looking for other locations in the Regions to install and evaluate similar trench drain products. If you are aware of a location in your region that could benefit from the installation of a trench drain to eliminate standing water, please contact Ken Berg at 965-4321

Satellite photo showing standing water after a storm.

Run-off making its way into the drain during a recent storm.

By Joni DeMille and Abdul Wakil
UDOT Research Division

UDOT's Lester Farnsworth Wire Library

The Utah Department of Transportation (UDOT) Lester F. Wire Library serves the employees of UDOT and the Department of Public Safety, with limited services also available to the public.

In addition to many services that the library provides, it is a great place for mostly transportation-related information and is an important resource to our Research Division. National data also support the idea of having an in-house library. A research study by Griffiths and King shows that the overall return on investment for supporting an in-house library ranges positively from a low of 7.8 to 1, to a high of 14.2 to 1.

The Wire Library houses over 18,000 publications, including technical reports, newsletters, magazines, audiocassettes and videos, information about current transportation issues, and more. It also houses a training room designed for technology transfer and educational purposes, such as technical training, video conferencing, webinars, and presentations.

The UDOT Library is named after Lester Farnsworth Wire (September 3, 1887 - April 14, 1958). Mr. Wire was a police officer with the Salt Lake City Police Department and wrote Salt Lake City's first traffic rules, and organized and led the first traffic squad in the city.

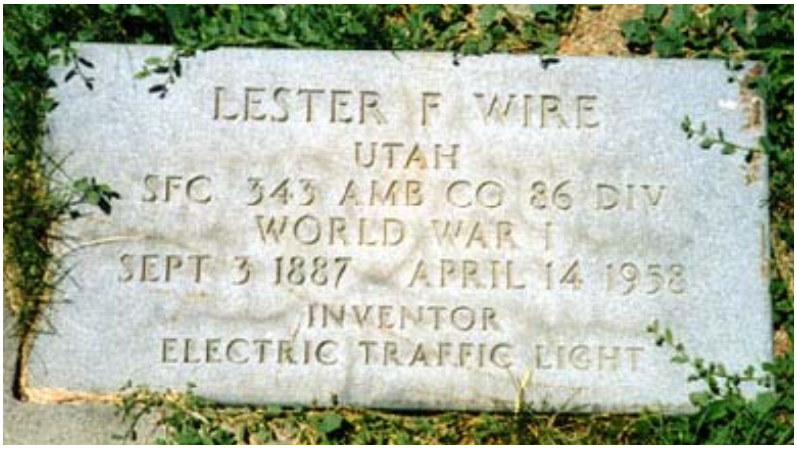
In 1912, Lester Wire invented the first electric traffic light for automobiles in Salt Lake City. The first model of his invention was a large, hand-made, yellow wooden box with a slanted roof to protect it from rain and snow. It resembled a flashing birdhouse. The lights used were Mazda lamps that had been dipped in red or green watercolors, and set inside 2, 6-inch circular openings on each side. The idea for using red and green lamp colors came from seagoing vessels and railroad signals, where red and green were used to indicate 'stop' and 'go,' just as they are now. The finished box was mounted on a 10-foot pole, and wired into the overhead trolley and light wires to obtain electricity.

By many accounts, the electric traffic light invented by Lester Wire in Salt Lake City was actually the first such light in the entire world. One such account was

written by Genevieve V. Hunt in 1956: "Lester Wire thought up the idea of using colored lights to direct traffic instead of the outstretched, reaching arms of a policeman. Drawing up rough plans, he wrote to the Gamewell Company in Massachusetts about his idea, and a representative of the … police and fire alarm … came to Salt Lake City… He was favorably impressed and helped Lester work out the details of the first electrically operated traffic signal in the world."

Hunt continues, "These first electric traffic signals, or semaphores, forerunners of the stop-and-go lights were placed on 10-foot stands at the middle of the downtown intersections, with a traffic officer stationed at each signal to direct the traffic by a twist of the wrist. Frequently, these first semaphores would be found early in the morning a mass of wreckage.

"The next phase of the system was the suspension of the semaphore from overhead wires, safe out of the reach of careless drivers and careening cars; leaving the directing officer remotely located from his mechanical device.



"Then came the little coops hanging on the corner light poles, where the officer sat inside flipping a switch back and forth. Lester recalls with a smile, that often the officer was accused of playing favorites in giving the east-west cars more time to go than the north-south cars."

Lester F. Wire's first traffic light was installed at the intersection of Main Street and Second South in Salt Lake City in 1912.

Lester Wire improved upon his first model several times, but he never patented his light and never received any money for its invention.

Mr. Wire is buried in the Salt Lake City Cemetery located at 200 North Street.

The Research Division is proud to remember the contributions of this great Utahn with a library named in his honor, and we invite you to view the Lester Wire photographs and memorabilia on display inside the library lobby.

For questions regarding Lester F. Wire or any of the services provided by the Wire Library, please contact Joni DeMille jdemille@utah.gov, Rae Ann Jensen raeannjensen@utah.gov, or Abdul Wakil awakil@utah.gov.

By Abdul Wakil
UDOT Research Division

In The Know: A Look At Who We Are

An ongoing feature of our quarterly newsletter is an introduction to one of our Research & Development Division staff members. In this edition, we will introduce you to Ms. LaRie Cutler.

Nearly 35 years as a full-time mother and nearly a full time volunteer, LaRie returned to the work force and began working as a member of the Project Development support staff as an office technician in the Research Division in August 2007.

Previously LaRie has served on a number of state-wide boards including, USAAV-Prevention Committee, Coalition For Tobacco Free Utah, Coalition for Utah Families, Governor's Initiative for Families Today and the Utah Federation for Youth, where she served as Board President for two years. Ms. Cutler also served in different school PTA's as a Safety Commissioner and on the Rock Canyon Elementary Peer Team. "Volunteer work has been very rewarding to me in many ways and I am still involved in it, but on a much scaled-back order" said LaRie.

In addition to the volunteer work, Ms. Cutler also worked as a part-time library aide for five years while living in Florida, as well as several years in libraries in Utah including the Family History Library and the University of Utah library. LaRie studied History at the University of Utah. She has five children, one son and four daughters and the oldest daughter, Catherine Cutler, is the Electronic Tolling Manager for UDOT.

Ms. LaRie Cutler

We are very pleased to have LaRie as a member of our Research Team. You can contact Ms. Cutler @ lariecutler@utah.gov.

You Know You Need To Contact Research When...

- You would like to learn more about how a new product performs on the road.
- You have a brilliant idea and/or product and would like a team of brilliant dedicated people to research it.
- You are introduced to a promising technology and do not have time and funding to test it.
- You require any technology transfer information or any experimental feature tested.
- You have a problem to be researched and solved.
- You require diligent inquiry about a subject matter and an analysis of scientific data.
- You have an article and would like the Research Division to publish it for you in its quarterly newsletter.
- You are in need of information through inter-library loan from other States.
- And more

Need a Literature Search?

Research publications are valuable resources, documenting the results of important research projects. For a list of recently completed Research Projects, please visit the Research & Development website at: http://www2.udot.utah.gov/index.php?m=c&tid=235. If you would like to obtain an electronic copy or a printed copy of our completed research, please contact Abdul Wakil at awakil@utah.gov

Completed UDOT Research

The UDOT Research Division and Lester Wire Library provide an important service through literature searches. These searches help identify published information about a topic of interest. To request a search, provide a brief description and some key words and submit it to awakil@utah.gov. Or you can submit your request online @ http://www.udot.utah.gov/index.php/m=c/tid=895/

Please send your comments and questions about this Newsletter to Abdul Wakil awakil@utah.gov or (801) 964-4455